DECAY OF THE TEETH*

BY

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Dental decay, or dental caries as it is more properly called, is a disease which, as everyone knows, produces holes or cavities in the teeth. These occur where the tooth surfaces are protected from the normal cleansing action of the tongue, the lips and the cheeks or where the softer tissues of the root (Plate XXII) are exposed by recession of the gums with increasing age. There are three main sites: in the natural folds found in the biting surfaces of the posterior teeth, at the points of contact between the teeth, and at the junctions between the teeth and the gums. For convenience these are called occlusal, interproximal, and cervical danger areas (Fig. 1).

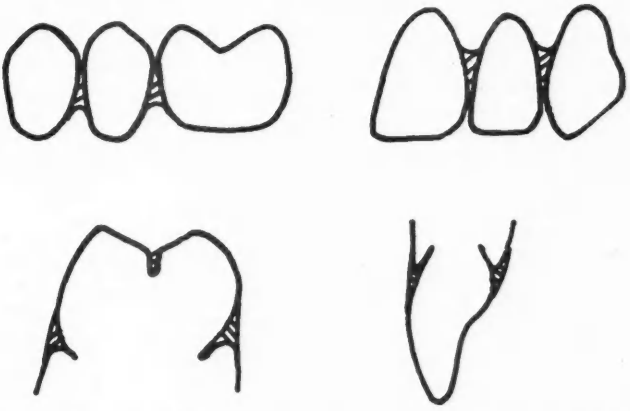

FIG. 1. *The "Danger Areas" for dental caries. These are stagnation areas around the teeth and include interdental and cervical areas and occlusal fissures.*

Stages of Decay

The lesion itself is first recognized, if it can be seen at all, as a small whitish patch in the normally translucent enamel. This does not mean that all whitish patches in the enamel are carious, but rather that all whitish patches occurring in the danger areas are very probably carious. The white patch gradually increases in size and the normally hard and glossy enamel surface becomes roughened. At the same time the lesion may become stained. Soon after the roughness is noticed the enamel surface in the centre of the lesion may break down to form a small cavity. This then progresses in size until the whole crown of the tooth may be involved(Plate XXIII(*a*)).

Because two of the three usual stagnation areas are in well protected sites, it is

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very difficult to find the early lesions and they cannot be recognized clinically until cavities begin to form. Fortunately radiographs help us to find some of these lesions at a fairly early stage, but we are now beginning to understand that any lesion which can be found by probe or radiography has already done much damage (Plate XXIII(*b*)).

Symptoms and Complications

At the same time as this process is occurring the patient begins to notice certain symptoms. About the time that the early cavity begins to form, the tooth may become sensitive to sweet foods and possibly also to salty foods. Such pain is at first transient, disappearing with the removal of the stimulus, but as the cavity increases in size and the disease penetrates further into the tooth the soft tissue in the centre of the tooth, which we call the pulp or nerve, becomes inflamed. This is slight at first but it results in an increased sensitivity of the tooth to sweet foods and painful sensation from heat or cold. As the condition progresses the pain becomes more intense and lasts longer until eventually the inflammation of the pulp becomes so severe that the pain is continuous. It mounts in intensity because of the increasing pressure within the pulp until the patient is at last driven to seek relief in one way or another. Fortunately, this final stage of acute pulpitis rarely lasts more than half to one hour, as the pressure within the pulp causes an obstruction of the blood flow and the pulp tissue dies. This is usually noticed as a sudden cessation of pain and often occurs as the patient rings the dentist's door bell.

At this stage of acute pulpitis the tooth is usually past saving for almost inevitably the inflammation will have passed beyond the tooth into the supporting structures (Fig. 2). Once this has happened, sooner or later it leads to the formation of a dental

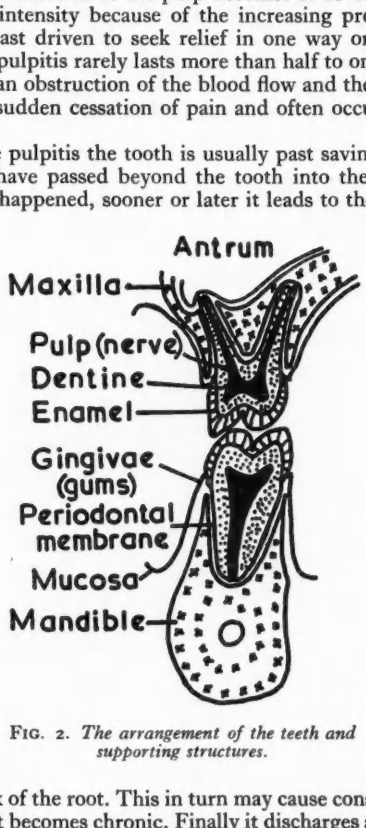


FIG. 2. *The arrangement of the teeth and supporting structures.*

abscess around the apex of the root. This in turn may cause considerable pain extended over several months if it becomes chronic. Finally it discharges and the pain is relieved. The infection however persists and a discharging sinus usually remains connecting the root of the carious tooth to the surface of the gum or face. In this stage the patient suffers no real pain except in acute exacerbations of the abscess.

The whole process from the onset of caries may take several years or may occur much more rapidly. Throughout this time the patient suffers periodic attacks of pain often being subject to some pain almost continuously. As for the infection, it is certain that this can at times cause systematic disease, but it seems unlikely that it causes much more than malaise and misery in most patients.

Fortunately today many of the sequelae of dental caries are prevented by good dental treatment at an early stage of the disease, but there are still far too many patients who prefer to avoid conservative treatment and wait till their teeth "fall out" or require extraction.

Having examined the natural history and complications of the disease we must now consider its scope.

Incidence

For many years now the percentage of school children in this country who are clinically free from caries has been 5 per cent or less. Being based only on clinical examination this simply means that they have no recognizable cavities and the figure is therefore probably too high. It is also known that in adults there are even fewer who have never had caries. This pattern is typical of most European people and their off-shoots in North America and Australia, while in New Zealand the condition of the teeth is even worse. Reliable figures are difficult to obtain from Asia but there seems little doubt that the caries incidence among Russians, Chinese and Indians is low, while in Africans living on their natural diet and in Eskimos before the arrival of trading posts, caries was almost non-existent.

Historically the advance of caries can be closely related to civilization. It is very rare in wild animals and in primitive man, but with the advent of each civilization its incidence seems to have increased. It was certainly known to the Egyptians, though probably it was not very widespread. By the time of the Romans it was already a matter of some importance and dental restorations were being used. In Britain during the Middle Ages it was quite commonplace. Since then it has steadily advanced until the present day.

Today we accept the fact that the schoolchild usually has at least one cavity for each year of life. On average each schoolchild produces one or two cavities each year and this may begin as early as 2 to 3 years of age or within one year of cutting the first tooth. This however is extreme, but it must not be forgotten that this picture is probably too optimistic for we can only count cavities. The early lesions are often inaccessible and therefore unrecognized. There are several cases on record where it has been necessary to extract all teeth for children of three to four years, solely because of caries. The teeth themselves showed no gross faults of structure. In fact the common story of chalky teeth is usually only an unsatisfactory excuse.

It is often suggested that pregnancy and other systemic conditions may increase the incidence of caries. There is no doubt that the structure of developing teeth may be affected by systemic disease, rendering them more susceptible to caries, but there is no evidence that the structure of the enamel of fully developed and erupted teeth can be modified. As for the relationship between pregnancy and caries, the evidence shows quite clearly that the incidence of caries in women of child bearing age shows no significant difference whether they have many, few or no children. It is therefore unreasonable to regard pregnancy as a cause of caries, though it is still wise for expectant mothers to have good dental treatment because of the possibility of pregnancy gingivitis and the desirability of avoiding radical dental treatment in late pregnancy.

An examination of the graph of caries incidence in this country shows that having started early, the number of new cavities steadily increases each year till a peak is reached roughly between the ages of 9 and 14 years. It then falls, probably because most of the danger zones are already carious and reaches a steady low incidence in the late 'teens. This is maintained until middle life when as the gums recede new cavities

begin to occur in the exposed roots. This cervical caries of middle age is relatively a minor problem. The major problem is the loss of teeth in childhood, for it is now known that the premature loss of baby teeth and of permanent teeth in early life can cause many dental deformities and can contribute to the causation of pyorrhoea in later life.

It has now become a matter of national importance that caries should be prevented. Whether we consider it as a financial matter of the cost of treatment under the health service or as the loss of man hours from toothache and treatment, or simply as a question of pain and misery, it still affects everyone and causes altogether too much trouble.

If it is to be prevented then we must know something of its causes and pathology.

Pathology

The first real attempt to understand the process was made by Miller in 1890. He suspected that caries was caused by the fermentation of food stagnating around the teeth. To demonstrate this he took pieces of teeth and incubated them in a mixture of bread and saliva and eventually produced the first artificial caries, with lesions in many ways similar to the natural variety. On these experiments he built the theory that caries is caused by acid which is produced by the action of bacteria on refined carbohydrates stagnating round the teeth. This theory is still acceptable today with a few modifications.

Interest has always centred on the attack of caries upon the enamel for this is the tissue which must first be breached before the tooth is endangered. Unfortunately, in Miller's day it was thought that enamel consisted wholly of calcium salts, but about 1906 Bodecker demonstrated that it also contained a small amount of organic or protein material.

It had been recognized for some time that Miller's theory did not explain all the facts and when it was discovered that the protein or organic matrix showed distinct changes in caries a new theory was advanced. Caries was now said to be caused by bacterial attack upon the protein.

Further experimentation has now shown quite clearly that two processes are involved. These are the removal of calcium salts and the alteration and destruction of the organic matrix. It is also clear that caries cannot occur without the stagnation of refined carbohydrates and without the presence of bacteria. It is highly probable that acid is produced which removes the calcium salts, but other methods are at present being suggested.

Prevention

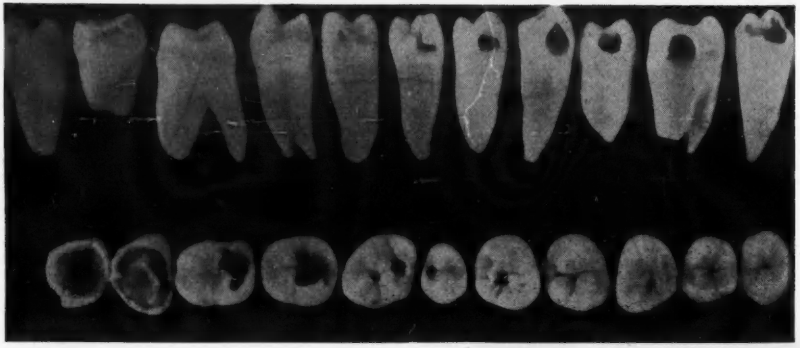
On this basis several methods of prevention have been tried. In animals susceptible to caries it has been shown conclusively that if bacteria can be excluded from the mouth no caries occurs, but in man it has been shown equally conclusively that while antiseptics and antibiotics will eliminate the organisms almost completely for a short time after their application the organisms return within the hour as the drugs are washed away by the saliva. The same is true of various chemicals which have been used to neutralize the acid and in addition there is considerable difficulty in getting the neutralizing agent to the sites where the acid is produced.

It is also known that where patients have been willing to exclude refined carbohydrates completely from their diets the caries incidence falls very rapidly and it seems quite clear from the evidence that most of the general variations in caries incidence with race or civilization can be explained by the amount of refined carbohydrate in the diet.

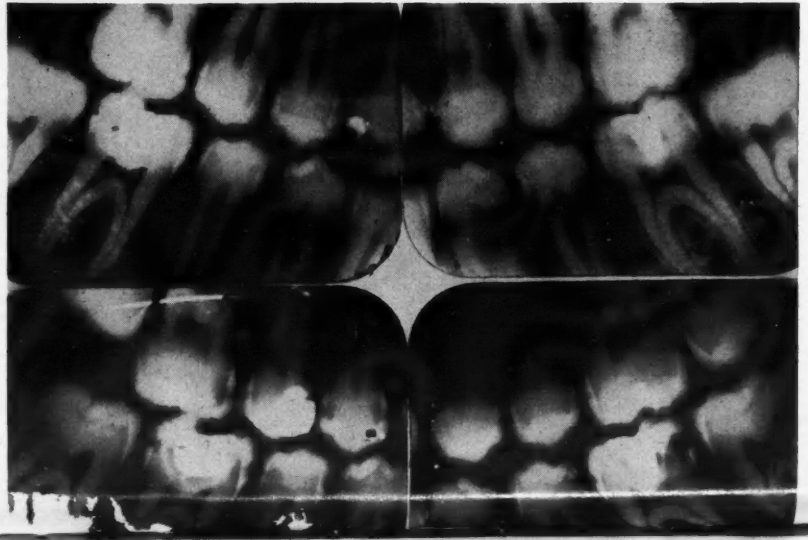
Many dental surgeons have limited the intake of refined carbohydrate by their children with a startling lack of caries as the result. Unfortunately even these children grow out of parental control and may become confirmed suckers of sweets between meals. Then unfortunately the caries begins. This is the real problem. How can dental

PLATE XXII

Ground section of tooth showing the body of the tooth consisting of dentine. The crown is covered by a layer of enamel which shows diagonal incremental lines. The pulp cavity is cut rather obliquely and should continue right through the apex of the root.



(a) The clinical stages of caries in interproximal and occlusal surfaces. The early stages are almost invisible.

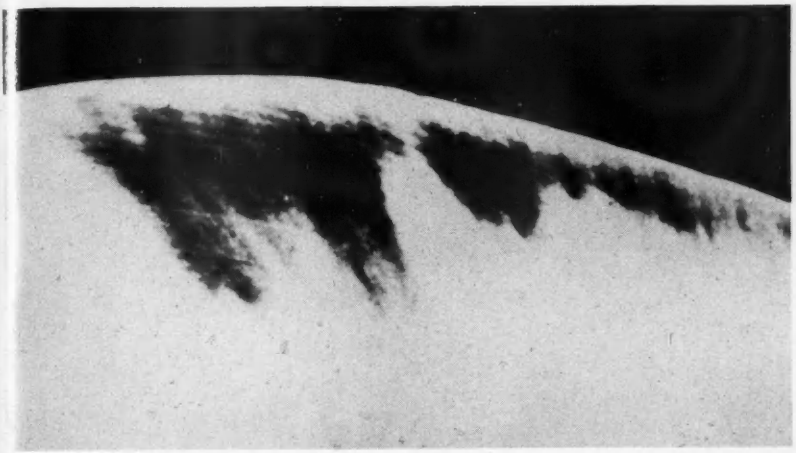


(b) Dental radiographs showing caries of the interproximal surfaces at various stages in a child.

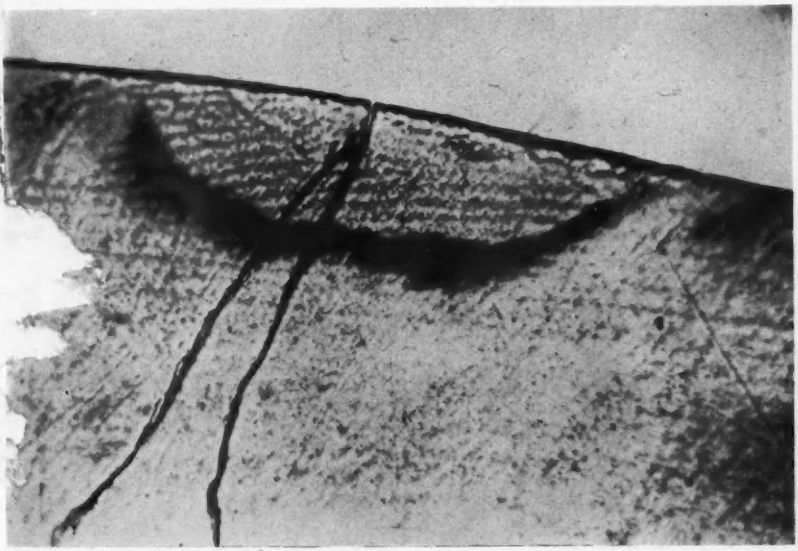
(b) Dental radiographs showing caries of the interproximal surfaces at various stages in a child.

(a) Stages of caries in interproximal and occlusal surfaces. The early stages are almost invisible.

PLATE XXIV

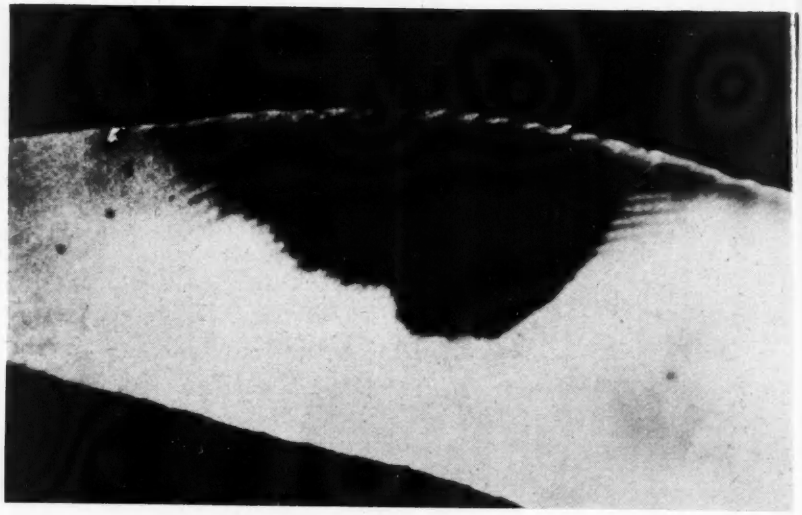


(*a*) *Soft radiograph of a ground section of carious enamel. The surface zone is apparently unaffected though there is marked decalcification beneath it.*

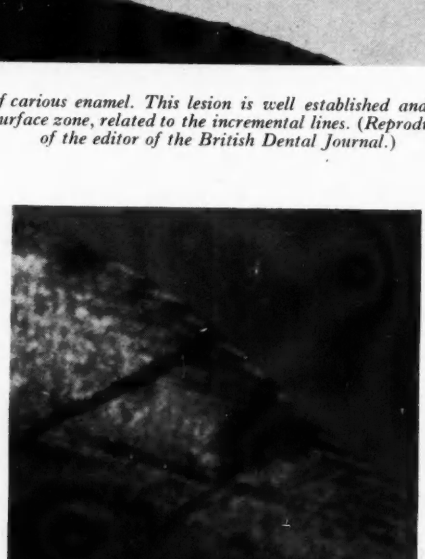


(*b*) *Ground section of early caries of the dental enamel. This shows the affected enamel surrounded by a characteristic dark zone. The translucent zone is hardly visible but usually lies between the dark zone and the normal enamel.* (*Reproduced by kind permission of the editor of the British Dental Journal.*)

PLATE XXV



(a) Soft radiograph of carious enamel. This lesion is well established and now shows the points of entry through the surface zone, related to the incremental lines. (Reproduced by kind permission of the editor of the British Dental Journal.)



(b) Ground section of an extremely early carious lesion of the enamel seen in air by polarized light. The dark areas running along the incremental lines are the points of entry and indicate 1 per cent of spaces in the thickness of the section. (Reproduced by kind permission of the editor of the British Dental Journal.)

caries be prevented without a serious change in our habits, for it would seem that the public do not yet regard dental disease as of sufficient importance to justify a change of habits.

Much can be done by the individual to reduce the stagnation of food around the teeth by tooth brushing and mouth rinsing. The latter is very valuable and consists of squirting water back and forward between the teeth immediately after meals. No-one would claim that this does more than reduce the incidence of caries and even so children present the real problem as it is difficult to get their co-operation in these exercises without the immediate supervision of an adult or until they become susceptible to reason, which is often after much damage has been done.

Fluorides

Perhaps the most important of all preventive measures has been the use of fluorides. Before the war it was noted that where the population had mottled teeth the caries incidence in children was only half that of similar communities without mottling. It was later discovered that the mottling was caused by a high concentration of fluorides in the water supply. Further investigation showed that the fluorides were also responsible for the reduction in caries incidence and that the same effect could be obtained without mottling by using one part per million of fluoride in the drinking water.

Many communities in America have been adding this amount of fluorides to their drinking water for periods of 10 years and more and they have consistently reduced the incidence of caries in their children by about 50 per cent. Recently a similar procedure has been tried in 5 centres in this country but it is too early to expect results. It is however confidently expected that similar results will be obtained. Unfortunately there has been a great deal of acrimonious and uninformed discussion of the dangers and even of the ethics of this procedure, but we are not concerned with these aspects in this paper.

Our interest lies in two facts. We are told that fluorine renders the calcium salts of the enamel much less soluble but only produces a 50 per cent reduction. We are also discovering that one of the principal features of the mottled teeth of gross fluorosis, which show little caries, is that they are badly calcified.

If our previous theories are correct poorly calcified teeth should be more susceptible to caries and not less. Nor are these the only badly calcified teeth to be unusually free from caries. We have recently had the opportunity of examining a series of 25 cases with a rare disease of the enamel called amelogenesis imperfecta, which is often hereditary and unrelated to fluorine. These teeth are also badly calcified and yet the incidence of caries in these patients was also remarkably low.

It would seem that we know little of the mechanism by which fluorides reduce the incidence of caries and indeed we know little of the process of caries.

Progress in Research

Too often in dentistry the process of disease has been guessed at from the appearances seen down a microscope, instead of finding new techniques which will positively identify the process. Too frequently sound observations have been ignored so that a convenient theory could be sustained.

Our work on caries began from two facts and two problems. It is well known to all dentists that caries develops at the contact points between teeth and that of the two surfaces in contact one may become carious while the other does not. At times the surface which becomes carious has been exposed to the cariogenic agents for less time than the non-carious surface. If the theories are correct both should become carious as they are subject to the same environment. The fact that they did not suggests that the structure of the tooth may be of importance.

The theory that acid formed from the fermentation of carbohydrates attacks the tooth, suggests that there should be a gradual erosion of the enamel, but as long ago as 1932 it was shown that when sections of early carious lesions were ground and X-rayed to see where the decalcification had occurred, a thin surface zone of enamel remained almost unaltered while the enamel beneath was decalcified (Plate XXIV(*a*)). This again implied a modification of the process by the structure of the enamel.

It had also been known for many years that two processes were involved in caries. The removal of calcium salts and the breakdown of the organic matrix. But while each school of thought had its own idea of which happened first, no-one seemed to know.

The appearances of the early carious lesions when seen down a microscope in ground sections of teeth, showed two zones surrounding the main lesion (Plate XXIV(*b*)). A dark zone next to the lesion which no-one could explain, and a translucent zone outside it which had often been described as a laying down of additional calcium salts by the tooth to resist the progress of the disease.

The investigations cannot be described at length in this paper, but some of the results are of interest.

Since the beginning of dental histology, the usual medium for mounting ground sections of teeth has been Canada Balsam. The section which is ground in water must be washed in alcohol and Xylol before mounting in the balsam. It was found that by using a watery medium not requiring the washing in alcohol the dark zone and the translucent zones disappeared. Further investigations with polarized light showed that these zones were caused by small spaces some of which became filled with balsam to become translucent and some probably with bubbles of gas to make them refract differently from the normal enamel giving the dark opaque appearance. This finding was at first accidental, but it is surprising that it had never been reported before, for watery media have been used in biology for many years.

The next step was to try to establish the nature of the early carious lesion and to decide whether the removal of the calcium salts occurred before the recognizable changes in the protein of the organic content or whether, as some thought, the reverse was true.

To do this we examined the evidence and discovered that most of the lesions in which organic change had been demonstrated were quite advanced and cavities were present. It was also apparent that some other changes were present which were well in advance of the changes in the organic material. It seemed highly probable that these earlier changes were caused by the removal of calcium salts.

Some very early lesions were then taken and split through the centre. From one half, ground sections were prepared and microradiographed for evidence of decalcification. The other halves were prepared and stained to show changes in the organic part of the enamel. In this way it was shown that calcium salts had been removed from these lesions before any change in the organic or protein part could be seen. Further investigation on these lines is still going on and we now know that decalcification occurs very early in caries. It is then followed by organic change at about the time when the surface begins to break down and soon after this the bacteria start to enter the enamel structure. Until this stage the bacteria have been producing their effects from a distance.

The greatest problems still remained. We could not yet explain how the carious process passed through the enamel surface zone without apparently affecting it and yet was able to cause a considerable loss of calcium salts within the deeper enamel. We had confirmed the previous evidence of a resistant surface layer and came to the conclusion that the process must enter through minute faults or openings which so far had not been demonstrated. It was obvious that the next step was to find these openings. We formed the opinion that though the openings must be extremely small at first they would probably increase as the lesion progressed. As a result we began looking at the more advanced lesions just before cavities would be expected. As is so often

the case they were found when we had almost given up hope. They showed on fine X-rays of the ground sections as small openings related to the developmental pattern of the enamel and consisted of several small openings rather than the single point of entry we had envisaged (Plate XXV(*a*)). At this stage we estimated that about 5 per cent of the calcium salts had been removed in these openings, while 25 per cent to 50 per cent had been removed in the underlying lesion. We were anxious to demonstrate them at an earlier stage and eventually, with the aid of biologists and physicists, devised a means for demonstrating the spaces from which material had been removed; first at about 5 per cent and later as low as 1 per cent of spaces. (Plate XXV(*b*)). The lesions with one per cent of spaces could not be found in even the most careful macroscopic examination, so they had to be sought in apparently sound teeth. Eventually such lesions were found and they showed the points of entry in precisely the same parts of the developmental pattern as they occupied in the later lesions seen by fine X-rays. At this early stage we could only recognise the spaces. We could not be sure what had been removed from them. It was therefore necessary to add an earlier stage to the process of caries. This stage occurs before recognizable decalcification, and is the production of minute spaces of unknown cause.

Then we had our greatest good fortune. With more experience of the use of fine X-rays and better techniques we began to get better pictures and quite suddenly we were able to distinguish structure within the carious lesion by this means. The results fitted very closely with our findings in polarized light, and we could now see not only the evidence of a loss of calcium salts but also the spaces from which they were lost. And more important still, we could see that calcium salts were being lost from some structures within the enamel and not from others. We already knew that this happened at the enamel surface when the small points of entry were opened up and it was necessary to explain these variations in the susceptibility to decalcification of the various structures in the enamel.

There are only two main components of the enamel—the calcium salts and the organic or protein part—and it seemed almost certain that one or the other was responsible for the difference in the susceptibility of the various structures to the removal of calcium salts.

The most probable cause seemed to be a difference in the calcium salts in the various structures but all the evidence suggested that the same calcium salt was present in all structures.

This left the organic or protein material as the other possible factor. It had recently been shown by one of our colleagues (Stack 1954) that this consists of two parts, one a keratin, which is very insoluble, and the other which has as yet no name except "soluble protein". Further investigation showed that the probable distribution of the two substances seemed to correspond closely with the distribution of the two groups of structures which were susceptible or resistant to the removal of calcium salts.

A new piece of information was then published by Rowles (1955). If one takes powdered enamel and treats it with dilute acid one would have expected the calcium salts to be dissolved, but it was shown that the first material to be dissolved was an organic substance which was almost certainly the soluble protein. After this some calcium salts were dissolved fairly quickly. Gradually the remainder of the calcium salts went into solution leaving finally a residue of insoluble keratin.

This was all we needed. We could now explain all our findings. It is too early to be certain, but it seems highly probable that the small crystals of calcium salts are embedded in or coated by the organic material, some by keratin and some by soluble protein. The surface layer probably consists chiefly of crystals coated with keratin, but at certain points a few crystals coated with soluble protein reach to the surface.

The attack of caries first dissolves the soluble protein exposing the crystals within to solution, while the keratin protects its crystals for a very much longer time. Thus the stages of caries previously mentioned can now be explained.

First spaces are produced, probably by the removal of soluble protein. This uncovers some of the crystallites of calcium salts and allows them to be dissolved. After this the keratin is attacked and begins to show recognizable histological changes. This process probably also results in the solution of the crystallites from within the keratin. Thus it seems that the initial attack may be not a decalcification but a solution of soluble protein.

Such a theory can explain several of our previous difficulties. It places the structure of the enamel of the individual tooth as a very important factor in deciding whether caries shall occur there or not. It also explains how the surface zone of the enamel can remain largely resistant to attack because its organic matrix is largely keratin and insoluble.

It could also explain the apparent anomaly that badly calcified teeth develop little caries because the important factor in starting the lesion is not the calcium salts but the nature of the protein, and already it can be shown that the protein of the enamel in these teeth shows differences from the normal.

The next question is what causes the attack? There seems no good reason to change our ideas and we still think in terms of a dilute acid produced by the breakdown of refined sugars and carbohydrates by bacteria.

Finally comes the question of treatment and prevention, in the light of our findings.

If our theory is true it may be possible to fill the spaces in the early lesions when they are accessible with some inert material, allowing it to be drawn in by capillary attraction after drying. This might be possible and would probably prevent further progress of the lesions.

But more important still, if the theory is correct we must stop looking for some means of making the calcium salts insoluble. What we require is a means of making the soluble protein insoluble. If this can be done we may well be able to prevent dental decay.

Finally, the real answer would be to learn more of these points of entry which seem to be developmental faults, so that their occurrence might be prevented in development.

Of course so much of this is conjecture that it may all be wrong, but at least we know more of the pathology of caries than we did, and there is some encouragement, for within recent months we have been able to produce artificial lesions, in extracted teeth, which are almost identical with natural decay by using a solvent which attacks only the soluble protein.

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LUNG CANCER—A SYMPOSIUM

PART I—A General Review

BY

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In opening this evening's symposium, I trust we can all agree that without doubt lung cancer has shown a true rise in incidence in the past quarter of a century. Improved diagnosis has certainly played its part but, in my opinion, cannot account for anything like the great increase which is apparent during this time. In 1930 bronchial carcinoma accounted for about 2 per cent. of all cancer deaths; by 1950 this figure had risen to 20 per cent. The Regional Cancer Bureau now tells us that bronchial neoplasms are commoner than any other, forming about 10 per cent. of all cancers.* Herein lies the challenge to us all.

The few figures which I shall produce to illustrate the subject are the average of a number of publications including the largest series of over a thousand patients analysed by the British Empire Cancer Campaign and some 280 patients under my own care.

The peak of age incidence occurs around 54 years but no age group is exempt, the youngest reported being 4 years and the oldest 100. Males suffer more than females in the proportion of at least 6 to 1 though possibly this difference is slowly lessening.

Concerning aetiology, I do not propose to open up the subject of the possible relationship of cigarette smoking to cancer. This has received quite enough fiery attention in the lay and medical press. Whatever the truth, we must be prepared to diagnose the condition in non-smokers, as were in fact the first three cases I saw after the real publicity drive started. Nor must we forget the importance of finding out what the relationship of atmosphere pollution may be to this condition.

One small point I would like to make about cigarette smoking is that it renders cough virtually valueless as a symptom by which we are to spot the early carcinoma. The smoker's cough merges so easily into the carcinoma cough—too gradually for the patient to appreciate it until too late.

SYMPTOMS

Our main concern is to arrive at an early diagnosis of a condition which may be so insidious in onset.

Cough and sputum themselves are unlikely to be very helpful symptoms for the reason I have just mentioned. Brassy cough previously emphasised is not perhaps such an early symptom as was thought because it may imply there is already mediastinal involvement. Shortness of breath for no other demonstrable reason must arouse suspicion; it can occur because a bronchus is fixed by growth before any lung collapse takes place. Pain in the chest, usually a late symptom due either to pleural or chest wall involvement, can also be an early one on occasion, localised over a small area of pulmonary collapse. Haemoptysis will always bring the patient to the doctor and lucky may be the man whose bronchial carcinoma bleeds early. Loss of weight is a late symptom and usually occurs only after matastasis has taken place.

I would say that most of the *early* cases are picked up in one of three ways: First, haemoptysis; second, a pneumonic type of attack where the affected part of the lung does not fully clear either clinically or radiologically or both—the "unresolved pneumonia" of former days. Thirdly, routine X-ray. In the first three-quarters of a million mass X-rays based on Bristol only one case of lung cancer was picked up in every 4,500. The incidence of cases sent by general practitioners to the static X-ray unit is around one in 300, showing how well aware these doctors are of this problem, and I can only exhort them to have even more chest X-rays performed on even slighter suspicion in future.

* Carcinoma of the breast in females alone is slightly commoner than carcinoma of the bronchus in males alone.

Apart from the evidence of bronchopulmonary infection which I have already mentioned, signs may be remarkable by their absence in the early stages before any bronchial obstruction has taken place. Sometimes evidence of bronchial narrowing may be obtained by the presence of weaker air entry to a lobe or segment, or of a "fixed" rhonchus over one area—one which cannot be coughed away—but it is only occasionally the stethoscope will be really more revealing than the X-ray as in the following case (Plate XXVI).

This man, aged 69, was complaining of severe shortness of breath and slight haemoptysis. His X-ray showed rather a heavy left hilar shadow and suggested collapse of the left lower lobe. Auscultation revealed almost complete absence of breath sounds over the whole of the left lung and urgent bronchoscopy showed, as I suspected, his left main bronchus was almost completely occluded by growth and the whole lung about to collapse.

METASTASES

In trying to assess whether a patient has a growth of early type, we should of course know where we may particularly expect metastases. Table I gives an idea of this and the figures are, of course, post mortem ones. I would point out one notable omission—

TABLE I

Showing the site of metastases from bronchial carcinoma.
(727 cases : 636 autopsies)

	Per cent
Intrathoracic glands	90
Adrenals	41
Other lung	40
Abdominal glands	40
Liver	35
Kidneys	24
Bones	21
Brain	18
Extension to heart muscle	9

that of glands around the thorax, that is superclavicular or axillary, which are fairly commonly involved. Although 10 per cent. are said not to have had any metastasis by lymphatic spread to the mediastinum, we must remember that this apparently favourable type of growth, probably mostly peripheral in site, may nonetheless metastasise early through the blood stream.

I would also draw your attention to the high incidence of involvement of the abdominal glands usually around the coeliac axis and often involving the pancreas. These may cause symptoms such as vomiting, or haematemesis, and be mistaken for gastric carcinoma especially if a mass is felt.

One other site in which I have been especially interested is the spread to the heart muscle and of course pericardium. An auricle is usually involved, in 9 per cent. of cases as you see, and results often in an arrhythmia such as auricular fibrillation; this may indeed by the presenting sign.

There are other unusual methods of presentation: bleeding from the rectum I have seen from a secondary deposit in the sacrum, thrombocytopenic purpura in a man of 80 due to bone marrow invasion, "arthritis" so-called, really pulmonary hypertrophic osteoarthropathy which is fairly common even without much associated sepsis in the chest; and perhaps strangest of all, a girl of 21 with erythema nodosum who at autopsy had a large anaplastic bronchial carcinoma with no evidence of tuberculosis anywhere.

DIAGNOSIS

Normally we hope to arrive at an early diagnosis firstly by being suspicious of symptoms however vague and whether supported by physical signs or not; secondly by X-ray findings, including tomograms: there again, suspicion of any odd shadow in the lung plays its part. In fact, the absence of any radiological abnormality does not

exclude a growth; I have seen a normal X-ray in a man who had intense dyspnoea and bronchoscopy revealed growth invading both main bronchi. Thirdly, bronchoscopy should give direct or indirect evidence of growth in the majority of cases, but by no means all of these give a positive biopsy. In the remainder and where findings are negative, we do not here recommend routine search of sputum for malignant cells; for the results achieved, the procedure is extremely time-absorbing for the pathologist and obviously many false negatives will be found. We consider it much safer in the doubtful case and, mark you, just the sort of case that may be curable, to proceed direct to exploratory thoracotomy.

DIFFERENTIAL DIAGNOSIS

This can raise difficult problems and I cannot now enlarge much upon them. I would say that the main differentiation is to be made from tuberculosis, bronchiectasis and lung abscess; not infrequently however, a carcinoma may co-exist with any one of these. A less well appreciated differential diagnosis is heart failure—shortness of breath, pleural effusion, perhaps haemoptysis and cervical vein engorgement which might be thought due to mediastinal obstruction. Very occasionally an unexpected foreign body will account for unexplained collapse of a lobe. Otherwise differential diagnosis is mainly a radiological affair.

PROGNOSIS

The average survival of untreated cases is only 10 months from the time of the first symptom, though some patients with squamous growths may live upwards of two years. Histologically, squamous cell growths form about a third of the total, some of course being more differentiated than others. They offer the best chance of a cure and the great majority of surgical successes lie in this group.

Surgery is the treatment of choice. It is the overall results which are so disappointing because until recently less than 40 per cent. of all cases were found worth exploring by thoracotomy and under 25 per cent. proved resectable. Many of these will already have metastasised beyond surgical bounds to recur later in one of the sites I have mentioned. The 5-year cure rate, which very closely resembles the 3-year cure rate, is only about 6 per cent. of *all* cases. No wonder we are depressed at this figure and no wonder we continue to encourage every effort towards early diagnosis of this very insidious disease.

About deep X-ray therapy I would like to make one point. Remembering that the usual type of case referred to the radiotherapist has much the worst prognosis and life can seldom be prolonged for more than a few weeks by that means, I think it is the duty of us all to resist pressure from anxious relatives for radiotherapy in order to feel that "everything is being done". This attitude is not fair to the patient nor to the radiotherapist and we should be allowed to adhere to our genuine indications.

I find that most of the patients whom I refer with a view to radiotherapy fall into the following groups, all of them being clearly unsuitable for operation by reason either of their local or general condition:

(1) Those with mediastinal obstruction.

(2) Those with severe pain from involvement of the thoracic cage by the primary growth (e.g. "Pancoast tumour") or by metastasis elsewhere (e.g. spine); even so, the palliative results may be disappointing in this group.

(3) When there is imminent threat of complete obstruction of a main bronchus.

(4) A variety of cases in which, after consultation with the radiotherapist, it is decided that the growth seems to be sufficiently well localized to recommend a trial of radical radiotherapy; implicit in this decision is the failure to demonstrate any suggestion of extrathoracic metastasis.

PART II

Radiology

BY

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X-ray of the chest is usually the first investigation needed in patients with chest symptoms. But the evidence gathered from these X-rays should be regarded as a supplement to the evidence already collected by the clinical examination—by inspection, palpation, percussion and auscultation—and a film may or may not show an abnormal shadow even when a growth is present.

It is true that serial X-rays may reveal the development and spread of a growth but further investigation such as bronchoscopy should not be delayed while diagnostic X-ray shadows are awaited, for by so doing we are conducting a radiological requiem in a previously treatable and perhaps curable case.

The following X-ray films are of cases which are grouped together according to the similarity of their shadows and their mode of presentation.

GROUP I

The first two cases are of proved bronchial carcinoma with very little radiological evidence of the disease.

Plate XXVII (*a*). (Male aged 62.) There is no abnormal shadow. At thoracotomy and left pneumonectomy the subaortic and hilar lymph nodes were enlarged, and on section the hilar nodes were invaded by metastases of squamous carcinoma.

Plate XXVII (*b*). (Male aged 59.) The X-ray is suspicious but not conclusive of abnormality above the left lung root. At operation a squamous growth was removed and this had involved the hilar glands. The patient three months before had a pneumonia-like illness with blood streaking of sputum and chest pain which continued until operation.

These two cases fortunately received effective surgical treatment without waiting for positive X-ray signs of growth to develop.

GROUP II

We will now consider the outcome of cases having more pronounced shadows.

These two cases also show the contrast between X-ray findings and clinical state.

Plate XXVIII (*a*). (Male aged 42.) Noticed a wheeze in December 1955, which gradually lessened but was replaced by shortness of breath. A sudden left chest pain followed in February 1956, which precipitated investigations. X-ray shows occlusion of the left main bronchus. Through the examining bronchoscope pieces of a soft fungating growth were removed with forceps, and the following day (Plate XXVIII (*b*)) the chest film shows complete re-expansion and no shadows of growth. Following pneumonectomy and clearance of interbronchial glands (oat-cell carcinoma) the man has enjoyed a useful life and a year later moved to Manchester.

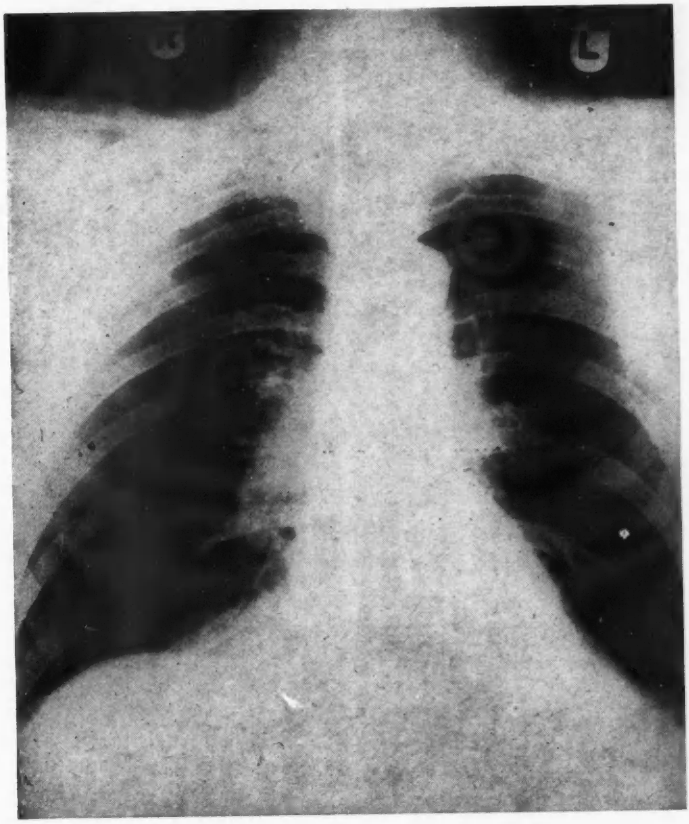
Plate XXIX (*a*) (Male aged 49). The X-ray shows a small shadow in the right upper hilar region which at thoracotomy proved to be a completely inoperable growth extending backwards into the mediastinum.

Decision as to operability can seldom if ever be made from the X-ray.

GROUP III

These next two cases illustrate unusual forms of presentation. Plate XXIX (*b*) (Female aged 19.) She had chest pain dyspnoea and cough increasing for 6 months before thoracotomy. Tuberculosis, and later sarcoidosis, were at first suspected to be

PLATE XXVI



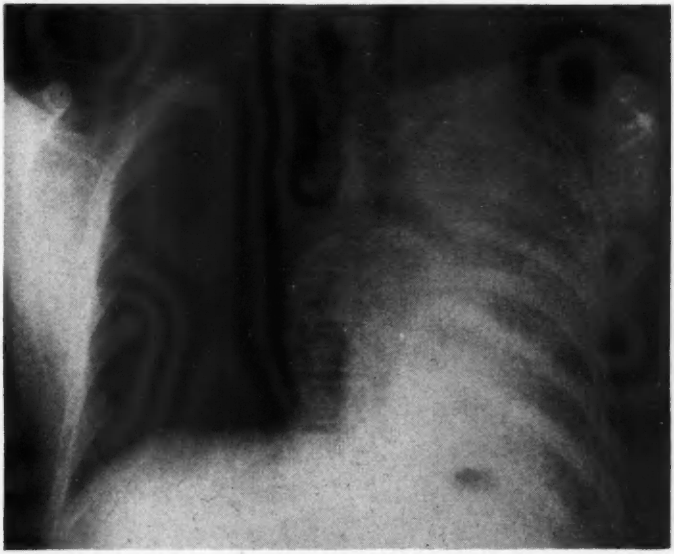
Chest X-ray of a man aged 69. The left hilar shadow is heavy. On physical examination, breath sounds were absent over the left lung. On bronchoscopy the left main bronchus was almost occluded by growth.

PLATE XXVII

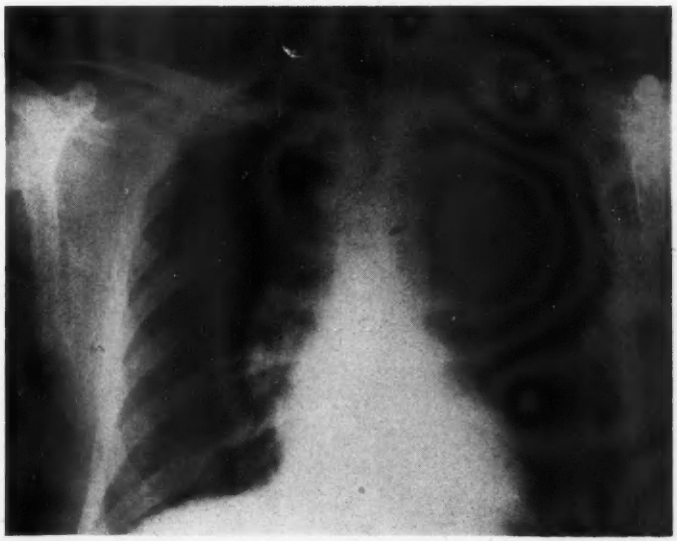
(a) At operation the left lung was removed and on section metastases were found in the left hilar lymph nodes.

(b) There is a suspicious shadow at the left lung root. At operation hilar lymph nodes were involved by growth.

PLATE XXVIII

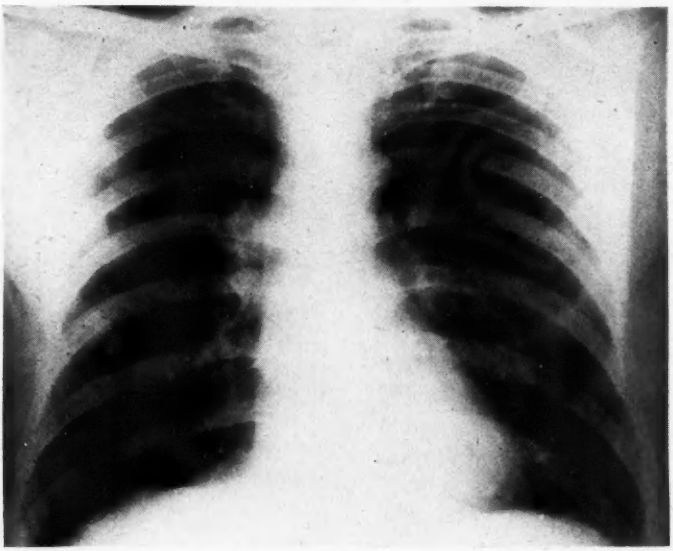


(*a*) *Collapse of the left lung.*

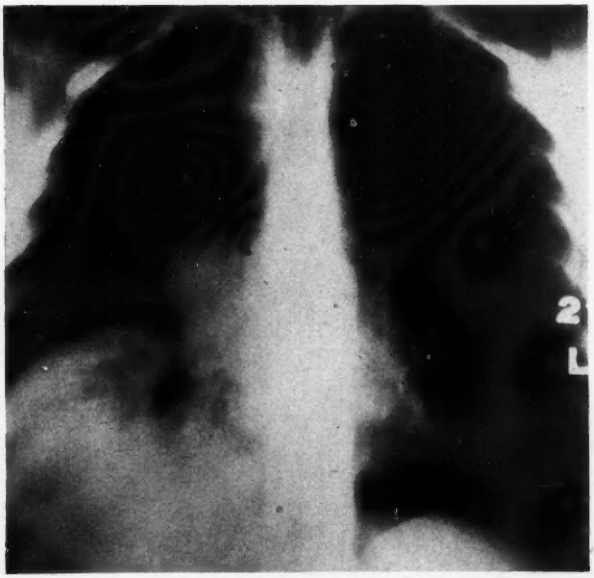


(*b*) *Re-expansion following removal of pieces of growth obstructing the left main bronchus. This patient is still alive and active after pneumonectomy.*

PLATE XXIX

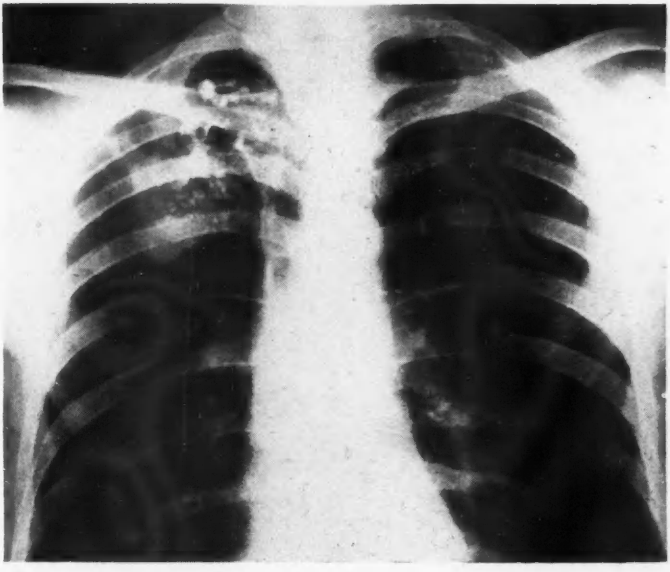


(a) There is only a small shadcw in the right hilum but at operation the growth was quite inoperable.

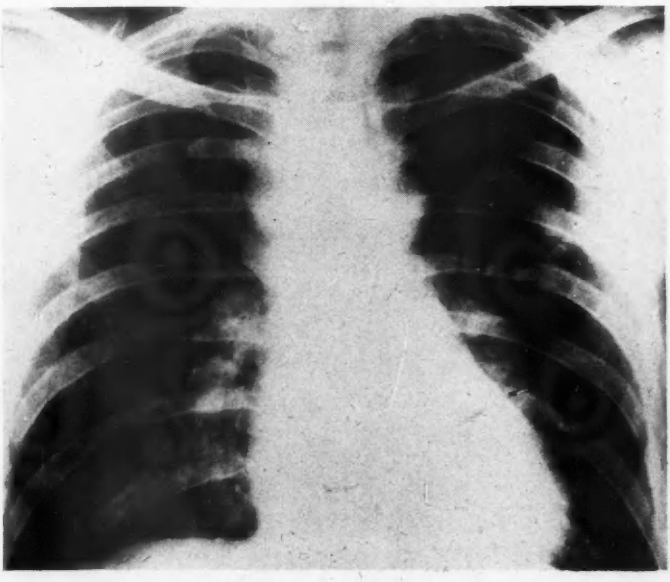


(b) Tomography in a girl of 19, showing a growth in the right stem bronchus. Clinically tuberculosis and sarcoid were suspected.

PLATE XXX



(a) This shows old quiescent tuberculosis and also an area of collapse due to a squamous-cell carcinoma in the right upper lobe.



(b) The peripheral carcinoma in the left lung was symptomless; the patient presented with symptoms from cerebral metastases.

(*a*), (*b*). *The periosteal thickening ("hypertrophic pulmonary osteo-arthiopathy") caused inability to work. The cancer in the left lung had caused no chest symptoms.*

the cause but bronchoscopy revealed growth in the stem bronchus. The tomogram film reproduced here shows these features well. The case was inoperable, growth having invaded the pericardium.

Plate XXX (*a*). (Male aged 56.) This man was under observation for quiescent tuberculosis when a second lung shadow of segmental right upper lobe collapse developed during an influenza-like illness. Thoracotomy confirmed the dual pathology and resection of a squamous growth without glandular involvement was carried out. Brain metastases however, developed 6 months later.

GROUP IV

This group are examples of bronchial carcinomata that were silent. Patients frequently present first with metastases in brain or skeleton in whom a primary asymptomatic growth is present in the lung.

Plate XXX (*b*). (Male aged 49.) Following an attack of paraesthesia in the right hand, this man had a fit and further cerebral localizing signs. Investigations revealed a small left lung peripheal shadow, and glands in the interbronchial and paratracheal positions. Cerebral biopsy confirmed an adenocarcinomatous deposit in the left hemisphere.

Plate XXXI (*a* and *b*). (Male aged 52.) A coalminer fractured his left tibia at work 8 months before an insurance assessment. He rightly stated his inability to work, but complained of no chest symptoms. Both leg films show diffuse periosteal proliferation and, in the chest film, there is a massive peripheral shadow. The periosteal change is that of a well-marked hyertrophic pulmonary osteopathy associated with lung disease.

SUMMARY

These X-rays serve to show how radiology of the chest in cancer patients must be integrated with the patient's history, physical signs, bronchoscopy and exploration of the chest.

LUNG CANCER—A SYMPOSIUM

Part III—Surgical Treatment

BY

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The results of treatment for cancer of the lung can cause nothing but gloom. The results of a personal series of cases treated in the South-West Regional Thoracic Unit are summarised briefly in Table II. The overall five-year survival rate for the whole

TABLE II

Bronchial carcinoma

1942–1957 = South-West Regional Thoracic Unit at Frenchay Hospital.
1,239 cases admitted to Surgical Unit
625 inoperable on bronchoscopy
182 inoperable at thoracotomy
432 resected
Overall 5 year survival rate (1945–51) = 5 per cent.
(Whole South-West Region)

South-West Region from 1945-1951 is only 5 per cent. The reason is delay in diagnosis and in treatment, rather than any unusual or excessively macabre feature of this disease.

The only method of cure known at present is surgical resection. When this operation

can be performed at all, (for the most part for advanced disease with extensive involvement of hilar and mediastinal lymph nodes), the five year survival rate is 31.8 per cent. which is better than the corresponding figures for cancer of the bladder, skeleton, larynx, stomach, kidney or prostate. (See Table III).

TABLE III

Survival rate following resection

Of the 432 lung resections for carcinoma the 5 year survival rate for resected cases has been 31·8 per cent., compared with the following results in some other sites for carcinoma:

Bladder	31 per cent
Bones	28·5 per cent
Larynx	23 per cent.
Stomach	21 per cent.
Kidney	20 per cent.
Prostate	15 per cent.

Despite the fact that bronchial carcinoma is still a "surgical disease" probably not more than 50 per cent. of cases are ever seen by a surgeon. This implies that decisions on operability are being made elsewhere. Obvious metastases in the C.N.S., skeleton, or liver, exclude all consideration of surgical treatment. Enlarged lymph glands, possibly metastatic, merit a surgical opinion. But any decision on operability based upon radiological changes, bronchoscopic appearances, and the general condition of the patient, must be the responsibility of the surgeon who is going to perform the operation.

SURGICAL PROGRESS

Surgical technique advances and with this progress there is an increase in the operability rate in every form of malignant disease. The resection rate has risen from 10·4 per cent. in 1946 to 52·2 per cent. in 1956, and these figures afford a little encouragement in an otherwise gloomy situation. Both surgeons and anaesthetists have abandoned the traditional criteria of a patient's ability to withstand major surgery. Very few patients have been denied surgery on account of their poor general condition, which is so frequently due to the septic complications of bronchial obstruction. Previous cardiovascular catastrophies and lurid E.C.G. pictures do not preclude successful pulmonary surgery. In a personal series of 432 resections, many carried out by a registrar or house surgeon, the mortality rate has been 7·7 per cent. which compares favourably with published rates ranging from 11 per cent to 25 per cent. This figure can be attributed largely to good anaesthesia of the simple old-fashioned type, good physiotherapy and nursing, and the vigilance of the resident staff.

The surgical technique of pulmonary resection is now fairly well standardised. The intra-pericardial dissection of the lung root permits a more radical resection, including involved portions of the left atrium. Partial resection and reconstruction of the trachea is possible. A block dissection of enlarged mediastinal lymph glands is carried out routinely but often the enlargement is found to be inflammatory rather than neoplastic. Large sections of the chest wall involved by a peripheral carcinoma can be resected along with the lung, and reconstruction effected by stainless steel wire mesh. The post-operative morbidity rate is low and the more serious complications such as bronchial fistulae, pleural infection and contra-lateral lung infection have now been largely controlled.

Lung resection has become both more radical and more conservative. For hilar growths the radical pneumonectomy already described is performed. For peripheral growths a simple lobectomy is adequate. The long term results are as good and the functional results better than for total lung resections, owing to the lesser degree of compensatory emphysema that develops in the remaining lung tissue. About a third of

all lung resections for cancer are now limited to one lobe, but earlier diagnosis may justify an even higher percentage of partial lung resections.

CONTRA-INDICATIONS TO OPERATIONS

There are a few indefinite contra-indications to lung resection. Patients over 70 do not tolerate pneumonectomy well; on the other hand, patients of 75 and over may stand a lobectomy without difficulty. Gross contra-lateral emphysema may be a contra-indication but it is difficult or impossible to assess residual lung function from X-ray appearances. Gross chronic bronchitis is unfavourable but it is surprising what can be achieved by a short but vigorous course of pre-operative physiotherapy and dental toilet. Dyspnoea is no absolute contra-indication; it is a symptom of the disease and may improve after resection; nor are infection and pyrexia due to bronchial obstruction, for these can frequently be relieved by bronchoscopic clearance of the lumen before operation.

Paralysis of a vocal cord or the diaphragm does not always rule out resection, but obstruction of the superior vena cava almost certainly does. A lymphocytic effusion is no bar as it is due to secondary infection rather than pleural involvement by growth, but a bloodstained effusion usually rules out resection. The histology of the growth is ignored in assessing operability or prognosis, as some of the most satisfactory long term results have been achieved by resecting anaplastic oat-cell carcinomata.

EFFECTS OF RESECTION

What of the functional results following resection? The disability is less than would be expected. The average patient retains about 75 per cent. of his exercise tolerance, can return to his previous employment and hobbies, and lead a useful and happy life. A few cases may be crippled by pulmonary insufficiency. Unfortunately, pulmonary function tests are not of great clinical value, and the ward sister is often the best judge of a patient's cardio-pulmonary reserve.

A third of the patients who die within five years of resection succumb to non-malignant conditions, such as right heart failure, contra-lateral pneumonia, or unrelated disease with no evidence of any recurrence of the growth at autopsy. Some of these patients might be salvaged with more adequate physiotherapy. In this series of 432 resections there has been no instance of a second primary growth developing in the remaining lung; possibly because the patients are advised to give up smoking! Multiple lung primaries are very rare and there have been only two definite cases of bilateral primaries amongst the 1,239 patients admitted for investigation. In the few reported cases both primaries have usually occurred in the same lung.

EARLIER DIAGNOSIS

The main problem that worries the surgeon at present is how to achieve earlier diagnosis and earlier resection till such time as the Department of Preventive Medicine relieves him of the responsibility. The early symptoms are well recognised but their significance may be masked by their mildness. Radiological diagnosis is full of pitfalls. Any shadow can be caused by a growth and should be suspect till exonerated by complete investigation. The X-ray may be normal in the presence of advanced inoperable disease, and radiological improvement does not rule out cancer. There is no place for the prolonged observation of fascinating X-ray shadows, nor for the "come back in three months, for another X-ray" approach. Nor is there any place for the speculative course of antibiotics to see if the lesion will clear.

There are only two ways in which the diagnosis can be made with certainty: by bronchoscopy and by exploratory thoracotomy. A bronchoscopic biopsy is available in less than half the cases examined but the presence of a growth can be inferred with accuracy on collateral evidence in the majority, but it takes about 10 years of practice

in correlating endoscopic and operative findings before a reliable opinion can be expressed. One encouraging feature of the present situation is the increasing number of negative bronchoscopies that are performed. A negative bronchoscopy however, does not rule out a growth, and in consequence these cases are followed for at least twelve months. Recently, three early and possibly curable growths have come to light during such a period of observation. It is unlikely that a nation of hypochondriacs will be created by adequate early investigation, because the public have now been conditioned to expect it. Patients are far more surprised when told they have not got cancer of the lung than when their suspicions are confirmed.

Exploratory thoracotomy is the final court of appeal in many cases, and there should be no hesitation in resorting to this method of diagnosis. Examination of a frozen section or a quick smear examination may assist the interpretation of operative findings. Nobody would wish to subject a patient to an unnecessary operation but it is surprising how seldom exploration fails to reveal a growth. The "negative thoracotomy rate" is shown in Table IV.

TABLE IV

"Negative thoracotomy rate"

On 614 explorations, cancer was proven and confirmed by histology. There were 16 resections for chronic pneumonitis and 6 negative explorations, no serious disease being found.

Most of the sixteen resections for "chronic pneumonitis" were lobectomies for irreparably damaged lobes, but a few patients have lost a lung when a lobectomy would have sufficed had the inflammatory nature of the lesion been recognised at operation. The incidence of wrong diagnosis at thoracotomy is now very low indeed.

Bronchial carcinoma may remain silent till it is incurable but in the majority of cases diagnosis and treatment are possible within 3 months of the onset of symptoms, with the facilities available at the present time.

Unfortunately there is still no real sense of urgency in the profession's approach to this problem. The figures in Table V (Thompson 1957) for a Metropolitan region speak

TABLE V

Average delay
(A Metropolitan Region)

Onset of symptoms to operation	=	7·4 months.
Patient's delay	=	1·5 months.
Professional delay (G.P., Radiologist, Chest Physician, Chest Surgeon).	=	5·9 months.

TABLE VI

Duration of symptoms
S.W. Region
Symptoms present 3 months or longer
1950 : 69 per cent. of all cases
1955 : 70 per cent. of all cases.

for themselves, Mason has reported similar figures from the Newcastle region (Mason 1958). There is evidence that the position is more satisfactory in the Bristol area, but the figures in Table VI from the South-West Region afford no cause for complacency, and must be profoundly disappointing to all concerned in the battle against this disease. The present diagnostic procedure is cumbersome and inefficient. More concerted action is needed and there must be synchronous training of all available diagnostic and therapeutic missiles on the target. One of the more promising and fruitful

of recent developments is the combined out-patient and bronchoscopy clinic with both chest physician and surgeon in attendance. Time is saved and the patient spared a second bronchoscopy.

Not until this disease is treated by all concerned as an acute surgical emergency will the results of treatment improve.

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ALVEOLAR CELL CARCINOMA OF LUNG: A CASE ATTRIBUTED TO METASTASIS FROM A PANCREATIC CARCINOMA

A Clinical Pathological Conference of the University of Bristol Medical School.

CHAIRMAN: PROFESSOR T. F. HEWER

Professor T. F. Hewer: I will ask Dr. Pearson who looked after this patient to give us the clinical history.

Dr. J. E. G. Pearson: This lady was 66 when I first saw her in 1955. She was referred to me as "post-operative chest", nine months after she had had an arthroplasty operation for osteoarthritis of the left hip. No chest X-ray had been taken at that time so there was no chance of assessing whether or not it really was a "post-operative chest". Her main symptoms were cough and shortness of breath, which she originally dated from her operation, but a student, on fuller questioning, ascertained that she had, in fact, been breathless for a year before that.

She came into hospital with a cough, a fair amount of mucoid sputum—between 2 to 3 ounces each day—and her dyspnoea; she had a little chest pain of paradyspnoeic type. There had been no haemoptysis.

She was a healthy looking woman for her age. She became breathless rather easily after walking about in the ward.

On her first admission she had very few signs indeed in her chest but did have increased, almost bronchial, breathing in patchy distribution on both sides. This corresponded with the X-ray appearance of several consolidated areas. She was put on physiotherapy. She had not brought up any pus to speak of, and the pathologists found no specific organisms in the sputum: she improved a little and went out. I followed her up in Outpatients and throughout this time the X-ray appearance was slowly progressive and her symptoms certainly got slightly worse.

I took her in again the following year (1957) for another check-up, and to see if we could do anything more, hoping to make her well enough for bronchogram or bronchoscopy, but she remained too breathless to contemplate either investigation. She looked at me pathetically, as though we were doing little to help her—and in fact we weren't doing much! Throughout this time there were no abnormal cardio-vascular signs. Even as late as six months before death an E.C.G. was perfectly normal. With her lung picture we were always waiting for the onset of cor pulmonale and I would emphasize that there were no signs of bronchial obstruction. Later she developed numerous rhonchi, broncho-spasm and a few rales at the bases.

An incidental note is that she had haematuria. She had already been under Mr. Pocock because of papilloma of the bladder in 1944. This recurred and was cauterized. Intravenous pyelogram was carried out and the radiologist reported a possible filling defect in the right kidney, so that we considered the possibility of kidney neoplasm with pulmonary metastasis.

On her final admission two weeks before death she was very breathless and given oxygen. She showed no swelling of the ankles or signs of infection. Acute cor pulmonale was probably the immediate cause of her death.

Dr. J. H. Middlemiss (Demonstrating the radiographs). The first X-ray shows advanced osteoarthritis of her left hip. The second shows arthrodesis by central dislocation. I.V.P. reveals that both kidneys were functioning well. The possibility of a renal lesion was raised but in fact the apperance of these kidneys is within normal limits. The bladder appears normal and there is no evidence of bladder tumour, but then they have to be very big indeed to show radiologically.

The third X-ray shows her chest, the condition with which she came to Dr. Pearson. In the right upper lobe is an area of consolidation, solid lung not collapsed but deaerated. All alveolar spaces are filled with something. There is a further similar area in the right lower lobe, with the middle lobe aerated. On the left side the lingula and probably left lower lobe are affected.

The fourth X-ray shows her chest condition a year later. There is still solid lung in the right upper lobe with aeration at the apex of the lower lobe—not a great change. We discussed the possibilities and put forward such ideas as chronic inflammatory change and progressive massive fibrosis. The radiologists did not think this appeared to be neoplastic in view of the long interval of time and the lady's static condition.

The fifth X-ray was taken a year later: the process is still there. Upper lobe still solid; contraction of lower lobe with an irregular edge. Solid lung on the left. Compensatory emphysema of the middle lobe on the right. This was within 3 months of death.

Altogether there was not a great deal of change over a long period, the main feature being contraction of the process, getting smaller rather than bigger, so neoplasm was not a diagnosis one would put forward with any conviction. My view was that this process was fibrotic.

Professor Hewer: At autopsy she looked quite well nourished. There was the scar of the successful arthroplasty operation over the left hip. The neck veins were dilated and there was cyanosis: no clubbing of the fingers. There was no tumour in the breasts. The left pleural cavity contained a little and the right 200 ml. of clear fluid with no adhesions.

The trachea contained some extraordinary tenacious white mucus but there was no sign of hyperaemia; this absence of any indication of inflammation of the trachea was surprising because the lungs seemed to me, on external examination, to be full of pneumonic exudate with areas of organisation: that was my impression before I sectioned the lungs. On the other hand it did seem odd that there were no pleural adhesions. A culture from the trachea yielded no pathogenic organisms.

The lungs themselves presented a remarkable appearance and were heavy and almost completely airless. Large parts of all lobes were evidently full of gelatinous mucus but some firm nodular areas were also palpable and there were some deep scarred clefts on the pleural surface suggesting the presence of old areas of collapse. No tumour was visible externally and the hilar and mediastinal lymph nodes showed no gross sign of tumour or of enlargement. On section after fixation by injection through the trachea (Plate XXXII(*a*)) there were large areas of gelatinous consolidation, having in places a clear-cut lobular outline, and within these areas were smaller irregular firm grey masses that were clearly neoplastic and probably, judging by their opacity, carcinomatous.

In places there were old emphysematous bullae and it looked as though the neoplasm had invaded a lung that was already emphysematous. Nowhere could any tumour be found in the walls of any of the bronchi and there was no particular area of tumour that could be considered the starting point of the process. Many of the bronchi were completely filled with the tenacious clear mucus and many lobules were consequently collapsed but they were mostly filled with mucus and their alveolar outlines were still apparent. Large areas of the lung were quite translucent although solid.

From the gross appearance of the cut surface it was obvious that the firm grey areas were tumour and the tentative diagnosis of organized pneumonia was abandoned. The lymph nodes were not enlarged and contained no gross tumour metastases.

As there was a history of recurrent bladder papilloma a careful examination was made of this lesion; the bladder still contained a few small granular masses of tumour in the mucosa above the trigone but, to anticipate the results of microscopy, these were a transitional cell carcinoma bearing no resemblance to any of the cells in the lung.

The only other site of tumour was in the pancreas where, at the inferior margin of the centre of the body, was a hard scirrhous mass 3 cm. in diameter with some cystic areas containing tenacious mucus.

I came to the provisional diagnosis of alveolar cell carcinoma of the lung with a metastasis in the pancreas. It was clear that the bladder carcinoma had nothing to do with it.

The only significant changes in other organs were some hypertrophy of the right ventricle of the heart and dilatation and atheroma of the pulmonary artery, together indicating the presence of pulmonary hypertension. It is noteworthy that the kidneys were normal.

Microscopically, the solid grey areas in the lungs were due to a well differentiated adenocarcinoma of high columnar cells lining the alveolar spaces and often filling the lumen entirely, without damaging the walls (Plate XXXIII(*b*)). These columnar tumour cells were mucin-producing and accounted for the tremendous quantity of firm tenacious mucus that filled all the adjacent alveoli and quite a number of lobules. In the mucus were many macrophages (Plate XXXII(*a*)). There was no suggestion of scarring of the alveolar walls; everywhere they were intact and had the full content of elastic fibres. Some of the respiratory ducts were lined by normal respiratory mucosa but many had an adenocarcinomatous lining and so had some of the emphysematous bullae.

A single small metastasis was found microscopically in one of the hilar lymph nodes. The liver, spleen, kidneys, adrenals and mediastinal and abdominal lymph nodes, the vertebrae and ribs that were examined showed no tumour.

The most interesting feature of the histological study was provided by the tumour in the pancreas. This proved to be a primary adenocarcinoma of pancreas with some well differentiated areas closely resembling the pancreatic ducts (Plate XXXIII(*b*)). In places the tumour had entered lymphatic vessels and was also invading some small veins. It was indistinguishable from the tumour in the lungs and it became apparent that this was a case of primary carcinoma of the body of the pancreas with extensive pulmonary metastases invading the alveolar spaces and utilizing the alveolar walls as supporting structures.

Having disposed of the diagnosis of primary alveolar carcinoma of lung in this case I looked through our post-mortem records of the last twenty years and found that we had only two previous cases indexed as examples of this condition. They seemed worth examining critically.

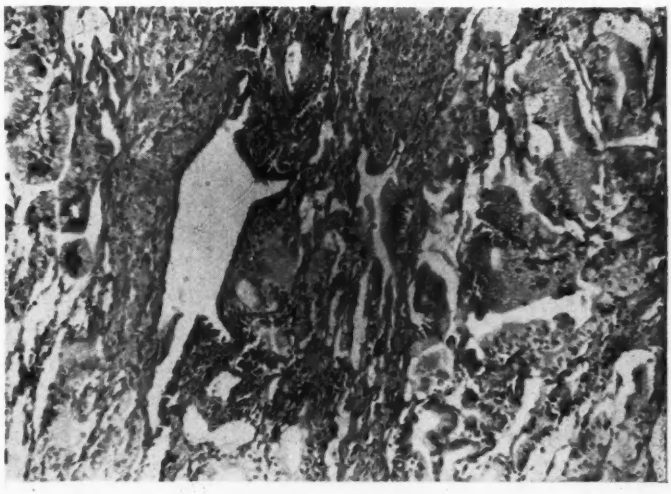
The first of these was a man of 65 and a piece of his lung was mounted in our museum as an example of alveolar carcinoma of the lung. There was a massive carcinoma involving a large part of one lung. The main bronchi within this lung were reported as being completely destroyed and unrecognizable. Microscopically it was a pleomorphic carcinoma, evidently bronchogenic in origin. Metastases were present in both suprarenals, liver and para-aortic lymph nodes. There was no real justification for calling this an alveolar carcinoma: it was a bronchogenic carcinoma invading the lung, filling the alveolar spaces.

The second case was a man of 39 whose lungs had diffuse carcinomatous infiltration with groups of intact alveoli lined by well differentiated columnar carcinoma cells. In this case there was also a small scirrhous carcinoma in the head of the pancreas and at the time there was great debate as to whether the primary was in the lung or in the pancreas. The metastases were much more widespread than in our present case. On reviewing the histological material there is now little doubt that it also was an example of primary carcinoma of pancreatic ducts with pulmonary metastases.

There have been several reviews recently of alveolar cell carcinoma of lung, which is sometimes called pulmonary adenomatosis, (Storey et al. 1953, Farber et al. 1954) most of which accept fully the idea that it is a multicentric tumour derived from the alveolar epithelium, or that of the respiratory ducts. Johansen and Olsen (1957), however, in their review of the subject report twelve cases of their own, one of which was due to a primary tumour of the pancreas; they mention that Eck (1955) doubted the existence of primary alveolar carcinoma of the lung. He actually reported three cases in which there was intra-alveolar spread of carcinoma of columnar cell type; one was

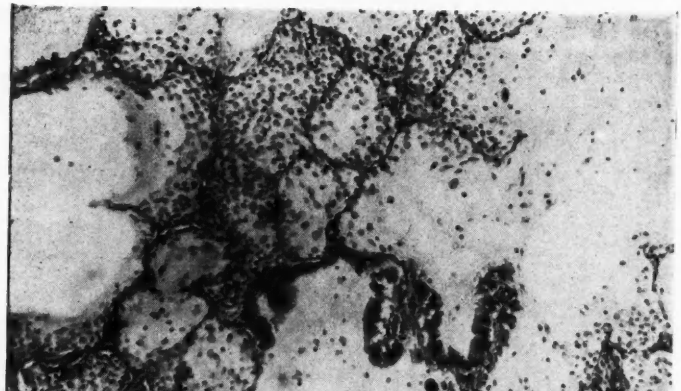
PLATE XXXII

(*a*) *Section through the lungs, showing areas of gelatinous consolidation and areas of growth.*

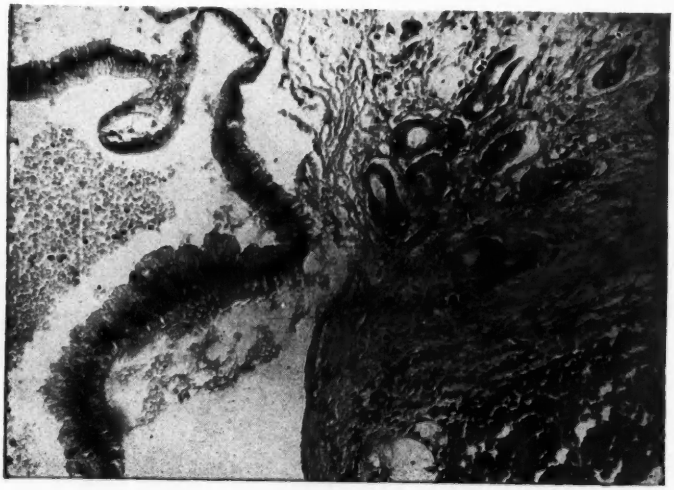


(*b*) (×.100). *Section of lungs, showing a well differentiated columnar cell adenocarcinoma lining the alveolar spaces.*

PLATE XXXIII



(*a*) (×.100). *Showing an area of the lung tumour in which there is copious mucin formation.*



(*b*) (×.100). *The appearance of the primary pancreatic adenocarcinoma.*

a metastasis from a primary pancreatic carcinoma, one from the rectum and one from a bronchus invading the lung.

Dr. Pearson: In seeking for a rare diagnosis for this unusual case I had thought of so-called alveolar cell carcinoma of the lung as quite a possibility: there are two main patterns of carcinoma of this type described; one is that of multiple small scattered areas sometimes mistaken microscopically at autopsy for bronchopneumonia, while the other shows one massive area. I reckoned that this case might be a mixture of the two forms.

The origin of alveolar cell carcinoma has always been in some doubt and the most popular view now is that it is a type of bronchiolar growth.

Dr. J. E. Cates: You said, Professor Hewer, that the tumour was only 3 cms. across, and yet it antedated the change in the lungs which had been present for two years. Is this all right from a pathological point of view?

Professor Hewer: Yes, it must have remained small for a long time—an extraordinarily long time—but well differentiated tumours like this may be very slow: there was a dense fibrous reaction around it.

Dr. Cates: Does the average carcinoma of the pancreas secrete as much mucus as that, or was it a peculiarity of metastases in the lungs?

Professor Hewer: No, they do not usually do so, but any tumour from a mucin-secreting mucosa may secrete a great deal of mucus.

Dr. A. B. Raper: I believe this tumour arose from the pancreatic duct.

Professor Hewer: Yes, it did and I think that may well be the explanation of the excessive mucin production. In conclusion I should like to stress the point that we ought to be very critical of any case of so-called alveolar cell carcinoma of lung and make an exhaustive search for an alternative primary.

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News from Societies

PROGRAMMES FOR 1959–60 SESSION

BRISTOL MEDICO-CHIRURGICAL SOCIETY

Secretary: Dr. B. E. McConnell, 4 Napier Road, Bristol 6

14th Oct.: **Annual General Meeting. Presidential Address.** F. W. Terrell Hughes, Esq., M.B., CH.B.
11th Nov.: **Clinical Meeting.** Frenchay Hospital.
9th Dec.: **Address** by Alan Moncrieff, Esq., C.B.E., M.D., F.R.C.P.
Further meetings will be announced in the next issue.

THE DEVON AND EXETER MEDICO-CHIRURGICAL SOCIETY

Secretary: Dr. F. S. W. Brimblecombe, 6 Barnfield Crescent, Exeter.

15th Oct., at 3 p.m.: **Clinical Meeting.**
29th Oct., at 3.30 p.m.: Professor Max Rosenheim, C.B.E., M.D., F.R.C.P. **"The Treatment of Nephritis".** (A combined meeting with the B.M.A. (Exeter and South Western)). Dinner.
19th Nov., at 8.15 p.m.: Jack Simpson, Esq., M.D., M.R.C.P., **"Confusion and Dementia in the Elderly".**
10th Dec., at 8.15 p.m.: **Clinico-pathological Demonstration.**
7th Jan., at 8.15 p.m.: Dr. Sheila Sherlock, M.D., F.R.C.P., **"Advances in the Treatment of Liver Disease".**
28th Jan., at 8.15 p.m.: **Clinical Meeting** at Princess Elizabeth Orthopaedic Hospital.
18th Feb., at 8.15 p.m.: J. Romilly Withycombe, Esq., M.S., F.R.C.S., **"Changing Trends in Urological Surgery".**
17th Mar., at 3 p.m.: **Clinical Meeting.** (Council Meeting to follow).
21st Apr., at 8.15 p.m.: **Annual General Meeting** and **Clinico-pathological Demonstration.**

B.M.A. (Bristol Division)

Secretaries: Dr. A. S. Anderson, 10 Leigh Road, Bristol 8, and
Dr. H. Temple Phillips, Berkeley House, Charlton Road, Westbury-on-Trym, Bristol.

9th Oct., **Annual Dance,** Grand Spa Hotel, Clifton.
18th Oct., at 2.45 p.m.: **St. Luke's Tide Service** in Bristol Cathedral. Preacher: The Right Reverend the Bishop of Bristol.
18th Nov., at 8.30 p.m.: Ian D. Grant, Esq., M.D., **"Medical Services and Conditions in Australia and New Zealand".** At the Royal Fort.
3rd May, at 8 p.m.: **Informal Reception** at Ashton Court Country Club.
4th May, at 8.30 p.m.: **Annual General Meeting** at the Royal Fort.
25th May: (Provisional date). **Clinical Meeting** at B.R.I.
10th June (Provisional date). **Reception for newly qualified doctors.** In the Garden Hall, Royal Fort.
Other meetings to be arranged.

B.M.A. (Cornwall Division)

Secretary: Dr. E. Townsend, Fieldways, Tregenna Lane, Camborne.

26th Nov.: **Annual Dinner and Dance,** Hotel Bristol, Newquay.
April: **B.M.A. Clinical Lecture.** Royal Cornwall Infirmary, Truro. (Details still under consideration.)

B.M.A. (Gloucestershire Branch)

Secretary: Dr. H. G. Scott-Kerr, 29 Leckhampton Road, Cheltenham.

8th Oct.: **Presidential Address.** C. de Vere Shortt, Esq., B.A., M.D., B.CH., B.A.O., **"Operation Overlord".** Cheltenham.
12th Nov.: **Clinical Meeting.** Representatives' Report, Annual Report and Financial Statement. Gloucester.
10th Dec.: **Address.** Sir Thomas Lund, C.B.E., Secretary of the Law Society, **"The Law of Negligence as it Affects the Medical Profession".** A Joint Meeting with the Gloucestershire Members of the Gloucestershire and Wiltshire Incorporated Law Society. Cheltenham.

14th Jan.: Paper. J. Lomas, Esq., B.A., M.B., B.CHIR., D.P.M., **"Tranquillizers in Psychiatry".** Gloucester.
11th Feb.: **"A Brains Trust".** Members of the Team: Four Gloucestershire Consultants. Cheltenham.
10th Mar.: Paper and Film. P. Boreham, Esq., M.CHIR., F.R.C.S., **"Indications for Prostatectomy".** Gloucester.
14th Apr.: **B.M.A. Lecture.** The Right Hon. W. S. Morrison, P.C., M.C., Q.C., M.P., Speaker of the House of Commons, **"The Doctor in Literature".** (Doctors' Ladies to be invited). Cheltenham.
12 May.: **Annual Meeting and Paper.** J. D. Riley, Esq., M.B., CH.B., **"The Medical Aspects of Motoring".** Winchcombe.
9th June: **President's Guest.** Brig. H. L. Glyn Hughes, C.B.E., D.S.O., M.C., O.H.P. Cheltenham.
Unless otherwise stated, the meetings will be held at 6.15 p.m. The place of the meetings will be stated in the circular notices.

B.M.A. (South-Western Branch)

Secretary: Dr. F. E. Graham-Bonnalie, St. John's House, 37 The Strand, Topsham, near Exeter.

25th Oct.: Exeter Division Golf Meeting, Dawlish Warren.
29th Oct., at 3.30 p.m.: **Combined Meeting** with the Exeter and South Devon Medico-Chirurgical Society. Speaker: Professor Max Rosenheim, C.B.E., M.D., F.R.C.P. Library, Royal Devon and Exeter Hospital. Followed by **Annual Dinner.**
7th Nov.: South-Western Branch Autumn **Clinical Meeting** at the Infirmary, Barnstaple.

BRISTOL SOUTH MEDICAL GROUP

Secretary: Dr. H. I. Howard, 102 Church Road, Bishopsworth, Bristol 3.

28th Oct.: John Naish, Esq., M.A., M.D., F.R.C.P., **"Facts and Fancies in Medicine".**
25th Nov.: Discussion Group 1; Royal Commission, 2; Members' Cases.
16th Dec.: **"Wines"** by Harvey.
10th Jan.: Films of Medical Interest.
7th Feb.: Competition—Social Evening.
8th Mar.: **Dance** to be held at Ashton Court Country Club.
April: **Annual General Meeting and Supper.** (Date to be announced later).

BRISTOL YOUNG DOCTORS' GROUP

Secretary: Dr. P. B. Bailey, Melba, Bristol Road, Whitchurch.

Meetings are held quarterly in the B.R.I. to discuss matters of topical interest.

COSSHAM MEDICAL SOCIETY

Secretary: Dr. K. W. Moulding, 235 Lodge Causeway, Bristol

6th Oct.: **Presidential Address.** J. H. Duerden, Esq., M.B., CH.B.
3rd Nov.: Mrs. D. Vinter, **"Old Kingswood".**
1st Dec.: R. H. Allen, Esq., M.A., B.SC., Visit to Kingswood Training and Classifying School.
5th Jan.: McDonald Critchley, Esq., M.D., F.R.C.P., **"Language of Gesture".**
26th Jan.: **Annual Supper Dance,** Ashton Court Country Club.
2nd Feb.: Professor A. I. Darling, D.D.SC., F.D.S., R.C.S., **"Common Disorders of the Teeth and Mouth".**
1st Mar.: W. T. Cussen, Esq., M.B., B.CH., **"Athletic Injuries."**
5th Apr.: **Annual General Meeting.**
15th June, at 2.15 p.m.: Visit to Fry's Factory at Somerdale.

BATH CLINICAL SOCIETY

Secretary: Dr. J. R. Bolton, 61 Englishcombe Lane, Bath.

10th Oct.: L. C. Hill, Esq., M.D., F.R.C.P., **"Pain".**
14th Nov.: **Clinical Meeting** at St. Martin's Hospital, Bath.
12th Dec.: J. Apley, Esq., M.D., F.R.C.P., **"The Evolution of Paediatrics".**
8th Jan.: H. Gibson, Esq., M.D., D. W. Pugh, Esq., M.D., F.R.C.P., T. L. Schofield, Esq., F.R.C.S., **Symposium on the Use of Anticoagulants.**
12th Feb.: **Joint Meeting** with the Bath Law Society at St. Martin's Hospital, Bath, to discuss the new Mental Health Act.
11th Mar.: L. H. Savin, Esq., M.D., M.S., M.R.C.P., F.R.C.S., Senior Ophthalmic Surgeon King's College Hospital, **"Facial Appearances in Disease".**
8th Apr.: **Clinical Meeting.**
23rd Apr.: **Annual Dinner** at Fortt's Restaurant.
All meetings will be held at the Royal United Hospital, Bath, unless otherwise stated.

CORNWALL CLINICAL SOCIETY

Secretaries: Dr. J. D. Hardy, Royal Cornwall Infirmary, Truro; and Dr. B. A. Gwynne Jenkins, Central Chest Clinic, Tuckingmill, Cornwall.

1st Oct.: J. H. Sheldon, Esq., C.B.E., M.D., F.R.C.P., **"Disturbance of Postural Control in Old Age".** Royal Cornwall Infirmary.
6th Nov.: **Clinical Evening.** Camborne-Redruth Hospital.
26th Nov.: **B.M.A. Dinner and Dance.** Newquay.
3rd Dec.: Professor R. A. Willis, M.D., F.R.C.P., **"Tumours in Infancy and Childhood".** Royal Cornwall Infirmary.
8th Jan.: **Clinical Evening or Quiz.** Camborne-Redruth Hospital.
4th Feb.: C. T. Andrews, Esq., M.D., F.R.C.P., **"The Story of Florence Nightingale".** Royal Cornwall Infirmary. (Ladies' Night).
4th Mar.: **Clinical Evening.** St. Lawrence's Hospital, Bodmin.
7th Apr.: **B.M.A. Clinical Lecture.** Royal Cornwall Infirmary.
6th May: **Clinical Evening.** Camborne-Redruth Hospital.
2nd June: **Presidential Address and Annual General Meeting.** Royal Cornwall Infirmary.

ROYAL DEVON AND EXETER HOSPITAL POSTGRADUATE PROGRAMME

Secretary: Mr. H. Dendy Moore, 4 Magdalen Road, Exeter.

The Exeter Postgraduate Meetings will take place on Tuesdays at 8.30 p.m. from 13th October to 8th December.

SOCIETY OF MEDICAL OFFICERS OF HEALTH WEST OF ENGLAND BRANCH

Secretary: Dr. R. H. G. H. Denham, Council Offices, 8 Cleveland Place East, Bath.

The Society is divided into two sections, Northern and Southern. Each section holds four meetings a year, one of which being a joint meeting of both sections.
3rd Oct.: **Presidential Address.** G. F. Bramley, Esq., M.D., D.P.H., M.O.H., Gloucestershire. Taunton.
2nd Jan.: At Bristol. (Details not yet available).
2nd Apr.: At the Pump Room, Bath. (Details not yet available).
May: **Joint Meeting** of Northern and Southern Sections. (Details not yet available).

SOUTH SOMERSET MEDICAL CLUB

Secretary: Dr. D. M. Barry, X-Ray Dept., Yeovil General Hospital.

15th Oct.: J. F. Davidson, Esq., O.B.E., M.B., D.P.H., **"Public Health".**
19th Nov.: George D. Kersley, Esq., M.D., F.R.C.P., **"Rheumatic Diseases".**
21st Jan.: **Dinner and Dance.**
18th Feb.: J. A. Boycott, Esq., M.A., D.M., **"Infectious Disease in Boarding Schools".**
17th Mar.: Symposium. **"Local Medical Services".**
18th Apr.: K. C. Bailey, Esq., M.D., D.P.M., **"Mental Health Acts".**

TORQUAY AND DISTRICT MEDICAL SOCIETY

Secretaries: Dr. D. K. MacTaggart, Health Department, St. Marychurch Town Hall, Torquay; and Dr. J. B. Taylor, Corner Place, Dartmouth Road, Paignton.

29th Oct., at 4 p.m.: Sir Ralph Marnham, K.C.V.O., M.CHIR., F.R.C.S., **"Antibiotics, their Use and Abuse",** at 7.30 p.m.: **Dinner and Dance** at the Palace Hotel, Torquay.
12th Nov.: S. Cochrane Shanks, Esq., M.D., F.R.C.P., F.F.R., **"Medicine, Radiology and the Law".**
3rd Dec.: J. F. Dow, Esq., B.A., M.B., F.R.C.P., **"More Harm than Good".**
28th Jan.: Sir Arthur Porritt, K.C.M.G., K.C.V.O., O.B.E., CH.M., F.R.C.S., **"The Problem of Breast Cancer, Past, Present and Future".**
25th Feb.: R. Bodley Scott, Esq., M.A., D.M., F.R.C.P., **"Recent Advances in Blood Diseases".**
10th Mar.: Wylie McKissock, Esq., O.B.E., M.S., F.R.C.S., **"Acute Cerebro-Vascular Accidents".**
31st Mar.: R. H. Gosling, Esq., M.D., D.P.M., **"The General Practitioner and Psychiatry".**
19th May: **Annual General Meeting.** Victoria Hotel, Torquay.
Meetings are held at the Torbay Hospital at 8.30 p.m. unless otherwise stated.

BRISTOL MEDICAL DRAMATIC CLUB

The next production will be **"The Ghost Train"** by Arnold Ridley at the Y.M.C.A. Hall in Trenchard Street, during the week beginning 30th November, 1959. Details and tickets may be obtained from Dr. P. B. Bailey, Whitchurch. Production by Dr. S. Curwen.